APPENDIX E

I. Modifications to the Baseline (tons per day) criteria pollutant emissions expected in the South Coast Air Basin in 2010

The current baseline scenario for MDVs (used in EMFAC) is based on the implementation schedule and emission standards as originally adopted by the ARB in 1990. This implementation schedule is listed in Table 1.

TABLE 1
BASELINE MDV LEV/ULEV IMPLEMENTATION RATES

Model-Year	Tier 1	LEV	ULEV
1998	73%	25%	2%
1999	48%	50%	2%
2000	23%	75%	2%
2001	0%	95%	5%
2002	0%	90%	10%
2003 & later	0%	85%	15%

Several changes have been made to the current (EMFAC) 2010 SCAB baseline inventory. The inventory assumes that emissions decrease proportionally to the ratio of the low-emission standard to the conventional standard. The current baseline inventory assumes that emissions from both chassis-certified and engine-certified low-emission vehicles decrease by the same proportions relative to Tier 1 vehicles. In actuality, the emission reductions attributed to LEV and ULEV MDVs by EMFAC are only accurate for chassis-certified vehicles. Accordingly, the following changes have been made to the emission inventory:

Assumptions for Chassis-Certified MDVs

For chassis-certified medium-duty vehicles only, NOx and NMHC emissions are assumed to be at the percentages of the Tier 1 standards contained in Table 2. (These percentages are currently applied to all MDVs by EMFAC.)

TABLE 2
CHASSIS-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle	100%	50%	100%
ULEV Vehicle	55%	30%	50%

Engine-Certified Vehicle Assumptions Modifications

Diesel Engines: 1995 certification data for M4/M5 diesel engines indicate that the actual NMHC and NOx proportions more closely resemble 5% NMHC/95% NOx.

Gasoline M4/M5: Auto manufacturer information indicate that approximately 72% of M4/M5 gasoline vehicles (> 8,500 lbs GVW) will be engine-certified and 28% will be chassis-certified. 1995 certification data for those M4/M5 gasoline engines which will continue to certify to the engine standards indicate that the actual NMHC and NOx proportions more closely resemble 15% NMHC/85% NOx.

The emissions for diesel engines and incomplete gasoline engines can, therefore, be better represented by the following assumptions.

TABLE 3
CURRENT STANDARDS FOR ENGINE-CERTIFIED VEHICLES

NMHC + NOx g/bhp-hr Standard	"comparable" NMHC g/bhp-hr Standard		"comparable" NOx g/bhp-hr Standard	
	diesel M4/M5	gasoline M4/M5	diesel M4/M5	gasoline M4/M5
3.9 (Tier 1)	0.20	0.58	3.70	3.32
3.5 (LEV)	0.18	0.52	3.32	2.98
2.5 (ULEV)	0.11 (assumed)	0.35 (assumed)	2.0 Std	2.0 Std

These new assumptions change the assumed ratio of emissions from diesel and gasoline engine-certified vehicles to the following percentages compared to conventional (Tier 1) vehicles.

Assumptions for engine-certified MDVs:

TABLE 4
DIESEL ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE
OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.11 g/bhp-hr NMHC	54%	55%	50%

TABLE 5
GASOLINE ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE
OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.35 g/bhp-hr NMHC	60%	60%	50%

Breakdown of Engine-Certified vs. Chassis-Certified Vehicles

(1) All MDVs up to 8,500 lbs. GVW will be chassis-certified.

(2) Medium-duty vehicle manufacturer information indicate that approximately 72% of M4/M5 gasoline vehicles (those >8,500 lbs. GVW which are currently considered light-heavy-duty gasoline vehicles) will be engine-certified and 28% will be chassis-certified. Therefore, the baseline emission inventory has been modified to assume that 72% of the M4/M5 gasoline vehicles use engine-certified percent reductions from Tier 1 standards and 28% of the M4/M5 gasoline vehicles use chassis-certified percent reductions from Tier 1 standards.

(3) All M4/M5 diesel vehicles will be engine-certified.

II. Revision to the tons per day criteria pollutant emission reductions expected in the South Coast Air Basin in 2010 using the MDV penetration rates assumed in the 1994 State Implementation Plan (SIP).

The 1994 SIP estimated emission reductions from a number of measures using a spreadsheet based on EMFAC and BURDEN models.

The estimated emission reductions from the enhanced MDV ULEV scenario contained in the SIP (presented in Table 6) were based on the assumption that the ratios of emissions from low-emission diesel engine-certified vehicles and incomplete gasoline engine-certified vehicles (8,500 to 14,000 lbs. GVW) compared to Tier 1 vehicles (i.e., LEV/Tier 1 emissions and ULEV/Tier 1 emissions) decrease proportionally to the ratios of emissions from low-emission chassis-certified vehicles compared to Tier 1 vehicles. As mentioned previously, this assumption has been determined to be incorrect.

TABLE 6
SIP MDV LEV/ULEV IMPLEMENTATION RATES

Model-Year	Tier 1	LEV	ULEV
1998	80%	10%	10%
1999	50%	25%	25%
2000	0%	50%	50%
2001	0%	25%	75%
2002 & later	0%	0%	100%

In the original spreadsheets used to estimate the emission reductions from the SIP MDV scenario, it was assumed that for both chassis-certified and engine-certified MDVs, NOx and NMHC emissions from LEVs and ULEVs were the following percentages of the Tier 1 standards.

TABLE 7
ORIGINAL SIP ASSUMPTIONS FOR BOTH CHASSIS-CERTIFIED AND ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	not in SIP
LEV Vehicle	100%	50%	not in SIP
ULEV Vehicle	50%	30%	not in SIP

Revised Assumptions for Chassis-Certified MDVs

TABLE 8
REVISED ASSUMPTIONS FOR CHASSIS-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle	100%	50%	100%
ULEV Vehicle	55%*	30%	50%

* This was changed from 50% to 55% because the NOx standard for most of the MDV classes is closer to 55% of the Tier 1 NOx standard than to 50% of the Tier 1 standard.

Engine-Certified Vehicle Assumptions Modifications

These assumptions are identical to those used to modify the baseline emission inventory.

Diesel Engines: 1995 certification data for M4/M5 diesel engines indicate that the actual NMHC and NOx proportions more closely resemble 5% NMHC/95% NOx.

Gasoline M4/M5: Auto manufacturer information indicate that approximately 72% of M4/M5 gasoline vehicles (> 8,500 lbs GVW) will be engine-certified and 28% will be chassis-certified. 1995 certification data for those M4/M5 gasoline engines which will continue to certify to the engine standards indicate that the actual NMHC and NOx proportions more closely resemble 15% NMHC/85% NOx.

The emissions for diesel engines and incomplete gasoline engines can, therefore, be better represented by the following assumptions.

TABLE 9
CURRENT STANDARDS FOR ENGINE-CERTIFIED VEHICLES

NMHC + NOx g/bhp-hr Standard	"comparable" NMHC g/bhp-hr Standard		"comparable" NOx g/bhp-hr Standard	
	diesel M4/M5	gasoline M4/M5	diesel M4/M5	gasoline M4/M5
3.9 (Tier 1)	0.20	0.58	3.70	3.32
3.5 (LEV)	0.18	0.52	3.32	2.98
2.5 (ULEV)	0.11 (assumed)	0.35 (assumed)	2.0 Std	2.0 Std

These new assumptions change the assumed ratio of emissions from diesel and gasoline engine-certified vehicles to the following percentages compared to conventional (Tier 1) vehicles.

Assumptions for engine-certified MDVs:

TABLE 10
DIESEL ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.11 g/bhp-hr NMHC	54%	55%	50%

TABLE 11

GASOLINE ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.35 g/bhp-hr NMHC	60%	60%	50%

Breakdown of Engine-Certified vs. Chassis-Certified Vehicles

(1) All MDVs up to 8,500 lbs. GVW will be chassis-certified.

(2) Medium-duty vehicle manufacturer information indicate that approximately 72% of M4/M5 gasoline vehicles (those >8,500 lbs. GVW which are currently considered light-heavy-duty gasoline vehicles) will be engine-certified and 28% will be chassis certified. Engineering Studies Branch staff has, therefore, modified the baseline emission inventory to assume that 72% of the M4/M5 gasoline vehicles use engine-certified percent reductions from Tier 1 standards and 28% of the M4/M5 gasoline vehicles use chassis-certified percent reductions from Tier 1 standards.

(3) All M4/M5 diesel vehicles will be engine-certified.

III. Determination of the emission reductions of criteria pollutant (in tons per day) expected in the South Coast Air Basin in 2010 based on the LEV and ULEV penetration rates contained in the staff's current "Enhanced" MDV proposal.

The staff's current "Enhanced" MDV proposal contains separate implementation rates for chassis-certified and engine-certified MDVs. Furthermore, the LEV NMHC + NOx standard is lowered from 3.5 g/bhp-hr (in 1998-2001) to 3.0 g/bhp-hr (in 2002). Table 12 contains the proposed implementation schedule for low-emission MDVs. Table 13 contains the applicable standards for this proposal.

TABLE 12
PROPOSED MDV LEV/ULEV IMPLEMENTATION RATES

Model-Year	Chassis-Certified Phase-in LEV NOx=ULEV NOx in 1998			Engine-Certified Phase-in LEV=3.0 g/bhp-hr NMHC+NOx in 2002-3 D -ULEV NOx=2.0, NMHC=0.11 G -ULEV NOx=2.0, NMHC=0.35		
	Tier 1	LEV	ULEV	Tier 1	LEV	ULEV
1998	73%	25%	2%	100%	0	0
1999	48%	50%	2%	100%	0	0
2000	23%	75%	2%	100%	0	0
2001	0	80%	20%	100%	0	0
2002	0	70%	30%	0	100%	0
2003	0	60%	40%	0	100%	0
2004 & Sub.	0	60%	40%	0	0	100%

Note: "D" indicates diesel engine-certified vehicles
"G" indicates gasoline engine-certified vehicles

TABLE 13
PROPOSED STANDARDS FOR ENGINE-CERTIFIED VEHICLES

NMHC + NOx g/bhp-hr Standard	"comparable" NMHC g/bhp-hr Standard		"comparable" NOx g/bhp-hr Standard	
	diesel M4/M5	gasoline M4/M5	diesel M4/M5	gasoline M4/M5
3.9 (Tier 1)	0.20	0.58	3.70	3.32
3.5 (1998-2001 LEV)*	0.18	0.52	3.32	2.98
3.0 (2002 & Sub. LEV)	0.15	0.45	2.85	2.55
2.5 ULEV Scenario	0.11 (assumed)	0.35 (assumed)	2.0 Std	2.0 Std

* Assumptions relating to the 3.5 g/bhp-hr standard are provided for informational purposes only and are not used to estimate emission inventory. (Engine-certified LEVs are not required until 2002.)

These new assumptions change the assumed ratio of emissions from diesel and gasoline engine-certified vehicles to the following percentages compared to conventional (Tier 1) vehicles.

Assumptions for engine-certified MDVs:

TABLE 14
DIESEL ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE
OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
1998-2001 LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
2002 & Subsequent LEV Vehicle 3.0 g/bhp-hr NMHC+NOx	77%	75%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.11 g/bhp-hr NMHC	54%	55%	100%*

* This is an increase in CO emissions from the current standard which is 50% of the Tier 1 standard.

TABLE 15
GASOLINE ENGINE-CERTIFIED MDV EMISSIONS AS A PERCENTAGE
OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
1998-2001 LEV Vehicle 3.5 g/bhp-hr NMHC+NOx	90%	90%	100%
2002 & Subsequent LEV Vehicle 3.0 g/bhp-hr NMHC+NOx	77%	78%	100%
ULEV Vehicle 2.0 g/bhp-hr NOx 0.35 g/bhp-hr NMHC	60%	60%	100%*

* This is an increase in CO emissions from the current standard which is 50% of the Tier 1 standard.

Assumptions for chassis-certified MDVs:

TABLE 16
CHASSIS-CERTIFIED MDV EMISSIONS AS A PERCENTAGE OF TIER 1 EMISSIONS

	NOx	NMHC	CO
Tier 1 Vehicle	100%	100%	100%
LEV Vehicle	55%	50%	100%
ULEV Vehicle	55%	30%	100%*

* This is an increase in CO emissions from the current standard which is 50% of the Tier 1 standard.

Breakdown of Engine-Certified vs. Chassis-Certified Vehicles

(1) All MDVs up to 8,500 lbs. GVW will be chassis-certified.

(2) Medium-duty vehicle manufacturer information indicate that approximately 72% of M4/M5 gasoline vehicles (those >8,500 lbs. GVW which are currently considered light-heavy-duty gasoline vehicles) will be engine-certified and 28% will be chassis certified. The ARB has, therefore, modified the baseline emission inventory to assume that 72% of the M4/M5 gasoline vehicles use engine-certified percent reductions from Tier 1 standards and 28% of the M4/M5 gasoline vehicles use chassis-certified percent reductions from Tier 1 standards.

(3) All M4/M5 diesel vehicles will be engine-certified.